from repetitive application of pulses, or one that performs the detection in real time with one shot of pulse triggered. If detection of impedance at all times is not required, then a frequency component may be superimposed to the output signal at an arbitrary timing to detect the impedance of the capacity. The waveform of an intermittent output signal used in detecting the residual voltage may be one in which a DC current is interrupted at an arbitrary time intervals and the residual voltage remaining on the load is measured immediately after the output is interrupted. Thus, observing the voltage remaining on the load allows detection of impedance of the capacity.

FIG. 7 illustrates a device for iontophoresis having a circuit for detecting the reactive current shown in FIG. 3. Referring to FIG. 7, reference numerals 31 and 32 denote a battery and a fixed resistor that limits the current flowing through a light-emitting diode (LED), respectively. Reference numerals 33, 34, and 35 denote an LED, a power switch, and a buzzer, respectively. Reference numerals 36, 37, and 38 denote microcomputer, a D/A converter, and a boosting coil, respectively. Reference numerals 39, 40, and 41 denote a coil-driving transistor, a rectifying diode, and rectifying capacitor, respectively. Reference numerals 42, 43, 44, and 48 denote fixed resistors that limit current. Reference numerals 45, 46, 47 denote output transistors. Reference numerals 49, 50, 51, 52, and 53 denote a current detecting fixed resistor, an analog switch, a current storing capacitor,

a discharge fixed resistor, and a voltage comparator, respectively.

The essential operation of the device according to the invention will now be described with reference to the figures. When the power switch 34 is pressed, the microcomputer 36 is activated to start to give a drug to a subject under a specific procedure previously programmed. The microcomputer 36 causes the LED 33 to light up and then causes the transistor 39 to oscillate to boost the voltage of the battery 31. When the transistor 39 oscillates, a back electromotive force is developed across the coil 38 and charges the capacitor 41 through the diode 40. The microcomputer 36 controls the transistors 45, 46 and 47, which are repeatedly conducted and non-conducted in opposite phase, and therefore the voltage across the capacitor 41 is outputted in the form of a rectangular wave having a certain frequency to the output terminal A. If a load has been connected across the output terminals A and B, a current in accordance with the impedance of the load flows through the output terminal B, causing a current waveform to appear across the fixed resistor 49 in accordance with the amount of current. The analog switch 50 operates to sample-and-hold only the positive waveform of the current. The sampled positive waveform is smoothed out by the capacitor 51 and is then outputted to the positive input of the voltage comparator 53. The negative input of the voltage comparator 53 receives the threshold level corresponding to a lower limit of the reactive current, which is the output signal of the

microcomputer 36 having been digital-to-analog converted by the D/A converter 37.

The voltage comparator 53 compares these two inputs and provides the comparison result to the microcomputer 36. If the output signal of the voltage comparator 53 is "H", the microcomputer 36 determines that conduction is normal. If the output signal of the voltage comparator 53 is "L", the microcomputer 36 determines that conduction is abnormal. When the conduction is abnormal, the LED 33 flashes and the buzzer 35 sounds to warn the operator. If the abnormal conduction state is not remedied a certain length of time after the warning, the output is interrupted and the operator is informed that the output has been interrupted, the buzzer 35 continuing to sound and the LED 33 being de-energized. Performing these operations in sequence secures the safety of the user.

FIG. 8 illustrates an iontophoresis device having a circuit for detecting a residual voltage, using a microcomputer. Referring to FIG. 8, reference numerals 54, 55, and 56 denote a battery, a fixed resistor that limits the current flowing through an LED, and an LED, respectively. Reference numerals 57, 58, and 59 denote a power switch, a buzzer, and a microcomputer that incorporates an A/D converter, respectively. Reference numerals 60, 61, and 62 denote a boosting coil, a transistor for driving the coil, and a rectifying diode, respectively. Reference numerals 63, 64-66, and 67-68 denote a rectifying capacitor, fixed resistors that